

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (currently amended): A method of automatically re-provisioning a network element in adaptation to a failure, the method comprising the computer-implemented steps of:
identifying a network element that has failed;
selecting a substitute network element from among a pool of one or more available network elements;
receiving connection configuration information from the identified network element;
and
based on the connection configuration information, re-configuring the substitute network element and one or more switch devices associated with the identified network element, wherein the re-configuring causes the one or more switch devices to change one or more connections from the identified network element to the substitute network element;
wherein the steps are performed by a cluster manager that is communicatively coupled to a cluster comprising a plurality of active network elements, the pool of one or more available network elements, a first network switch, and a second network switch.
2. (currently amended): The method as recited in Claim 1, wherein the identified network element is one of a plurality of network elements in a cluster that is associated with the first and second network switches.
3. (cancelled)

4. (previously presented): The method as recited in Claim 1, wherein the step of re-configuring comprises the steps of sending a trigger event to the substitute network element that causes the substitute network element to retrieve a configuration over a network connection.
5. (previously presented): The method as recited in Claim 1, wherein re-configuring comprises dynamically reconfiguring the selected network element as a logical clone of the identified network element.
6. (previously presented): The method as recited in Claim 1, further comprising the step of associating the identified network element with the pool of available network elements.
7. (previously presented): The method as recited in Claim 1, further comprising the steps of:
 - sending an initial configuration to the substitute network element;
 - sending a partial accumulated configuration to the substitute network element; and
 - sending instructions that cause the identified network element to reboot based on a configuration setting of a cluster associated with the identified network element.
8. (previously presented): The method as recited in Claim 1, further comprising the steps of:
 - receiving first user input in a graphical user interface that associates the network elements in a cluster with a first switch and a second switch;
 - receiving second user input that specifies which network elements are reserved in the pool of available network elements.

9. (previously presented): The method as recited in Claim 1, wherein each of the network elements is a network aggregation device or a network access server.
10. (previously presented): The method as recited in Claim 1, further comprising repeating the steps for multiple concurrently failed network elements.
11. (previously presented): The method as recited in Claim 1, further comprising the steps of:

receiving a message specifying a failure of a network element over an event bus on

which the network elements publish events and on which a cluster manager

subscribes to events;

based on the message, identifying the network element that has failed.
12. (previously presented): The method as recited in Claim 1, wherein the network switches are asynchronous transfer mode (ATM) switches, and wherein the network elements are routers in a packet-switched network.
13. (currently amended): A method of automatically re-provisioning a network element in adaptation to a failure, the method comprising the computer-implemented steps of:

receiving first user input that defines a cluster comprising a first network switch, a

plurality of network elements, and a second network switch;

receiving second user input that specifies one or more of the network elements as a

pool of available network elements;

identifying a network element that has failed;

selecting a substitute network element from among the pool; and

re-configuring the first network switch and the second network switch, wherein the

re-configuring causes the first network switch and second network switch to

change one or more connections from the identified network element to the substitute network element

wherein the steps are performed by a cluster manager that is communicatively coupled to a cluster comprising a plurality of active network elements, the pool of one or more available network elements, the first network switch, and the second network switch.

14. (previously presented): The method as recited in Claim 13, wherein the step of re-configuring comprises the steps of sending a trigger event to the substitute network element that causes the substitute network element to retrieve a configuration over a network connection.
15. (previously presented): The method as recited in Claim 13, wherein re-configuring comprises dynamically reconfiguring the selected network element as a logical clone of the identified network element.
16. (previously presented): The method as recited in Claim 13, further comprising the step of associating the identified network element with the pool of available network elements.
17. (previously presented): The method as recited in Claim 13, further comprising the steps of:
 - sending an initial configuration to the substitute network element;
 - sending a partial accumulated configuration to the substitute network element; and
 - sending instructions that cause the identified network element to reboot based on a configuration setting of a cluster associated with the identified network element.

18. (previously presented): The method as recited in Claim 13, wherein each of the network elements is a network aggregation device or a network access server.
19. (previously presented): The method as recited in Claim 13, further comprising repeating the steps for multiple concurrently failed network elements.
20. (previously presented): The method as recited in Claim 13, further comprising the steps of:

receiving a message specifying a failure of a network element over an event bus on which the network elements publish events and on which a cluster manager subscribes to events;

based on the message, identifying the network element that has failed.
21. (previously presented): The method as recited in Claim 13, wherein the network switches are asynchronous transfer mode (ATM) switches, and wherein the network elements are routers in a packet-switched network.
22. (currently amended): A computer-readable medium storing one or more sequences of instructions for automatically re-provisioning a network element in adaptation to a failure, which instructions, when executed by one or more processors, cause the one or more processors to carry out the steps of:

identifying a network element that has failed;

selecting a substitute network element from among a pool of one or more available network elements;

receiving connection configuration information from the identified network element;

and

based on the connection configuration information, re-configuring the substitute network element and one or more switch devices associated with the

identified network element, wherein the re-configuring causes the one or more switch devices to change one or more connections from the identified network element to the substitute network element;

wherein the steps are performed by a cluster manager that is communicatively coupled to a cluster comprising a plurality of active network elements, the pool of one or more available network elements, and the one or more network switch devices.

23. (previously presented): The computer-readable medium as recited in Claim 22, wherein the identified network element is one of a plurality of network elements in a cluster that is associated with first and second network switches.
24. (cancelled)
25. (previously presented): The computer-readable medium as recited in Claim 22, wherein the instructions for re-configuring further comprise instructions for sending a trigger event to the substitute network element that causes the substitute network element to retrieve a configuration over a network connection.
26. (previously presented): The computer-readable medium as recited in Claim 22, wherein the instructions for re-configuring further comprise instructions for dynamically reconfiguring the selected network element as a logical clone of the identified network element.
27. (previously presented): The computer-readable medium as recited in Claim 22, further comprising instructions for associating the identified network element with the pool of available network elements.
28. (previously presented): The computer-readable medium as recited in Claim 22, further comprising instructions for:

sending an initial configuration to the substitute network element;
sending a partial accumulated configuration to the substitute network element; and
sending instructions that cause the identified network element to reboot based on a
configuration setting of a cluster associated with the identified network
element.

29. (previously presented): The computer-readable medium as recited in Claim 22,
further comprising instructions for:
receiving first user input in a graphical user interface that associates the network
elements in a cluster with a first switch and a second switch;
receiving second user input that specifies which network elements are reserved in the
pool of available network elements.
30. (previously presented): The computer-readable medium as recited in Claim 22,
wherein each of the network elements is a network aggregation device or a network
access server.
31. (previously presented): The computer-readable medium as recited in Claim 22,
further comprising instructions for repeatedly executing the instructions for multiple
concurrently failed network elements.
32. (previously presented): The computer-readable medium as recited in Claim 22,
further comprising instructions for performing the steps of:
receiving a message specifying a failure of a network element over an event bus on
which the network elements publish events and on which a cluster manager
subscribes to events;
based on the message, identifying the network element that has failed.

33. (previously presented): The computer-readable medium as recited in Claim 22, wherein the network switches are asynchronous transfer mode (ATM) switches, and wherein the network elements are routers in a packet-switched network.
34. (currently amended): An apparatus for automatically re-provisioning a network element in adaptation to a failure, comprising:
means for identifying a network element that has failed;
means for selecting a substitute network element from among a pool of one or more available network elements;
means for receiving connection configuration information from the identified network element; and
means for re-configuring the substitute network element and one or more switch devices associated with the identified network element, based on the connection configuration information, wherein the re-configuring causes the one or more switch devices to change one or more connections from the identified network element to the substitute network element; and
a cluster manager that is communicatively coupled to a cluster comprising the failed and substitute network elements and the one ore more switch devices.
35. (currently amended): The apparatus as recited in Claim 34, wherein the identified network element is one of a plurality of network elements in a cluster that is associated with first and second network switches.
36. (cancelled)
37. (previously presented): The apparatus as recited in Claim 34, wherein the re-configuring means comprises means for sending a trigger event to the substitute

network element that causes the substitute network element to retrieve a configuration over a network connection.

38. (previously presented): The apparatus as recited in Claim 34, wherein the re-configuring means comprises means for dynamically reconfiguring the selected network element as a logical clone of the identified network element.
39. (previously presented): The apparatus as recited in Claim 34, further comprising means for associating the identified network element with the pool of available network elements.
40. (previously presented): The apparatus as recited in Claim 34, further comprising:
means for sending an initial configuration to the substitute network element;
means for sending a partial accumulated configuration to the substitute network element; and
means for sending instructions that cause the identified network element to reboot based on a configuration setting of a cluster associated with the identified network element.
41. (previously presented): The apparatus as recited in Claim 34, further comprising:
means for receiving first user input in a graphical user interface that associates the network elements in a cluster with a first switch and a second switch;
means for receiving second user input that specifies which network elements are reserved in the pool of available network elements.
42. (previously presented): The apparatus as recited in Claim 34, wherein each of the network elements is a network aggregation device or a network access server.

43. (previously presented): The apparatus as recited in Claim 34, further comprising means for using the other means repeatedly for multiple concurrently failed network elements.
44. (previously presented): The apparatus as recited in Claim 34, further comprising: means for receiving a message specifying a failure of a network element over an event bus on which the network elements publish events and on which a cluster manager subscribes to events; means for identifying the network element that has failed, based on the message.
45. (previously presented): The apparatus as recited in Claim 34, wherein the network switches are asynchronous transfer mode (ATM) switches, and wherein the network elements are routers in a packet-switched network.
46. (currently amended): An apparatus for automatically re-provisioning a network element in adaptation to a failure, comprising:
a network interface that is coupled to the data network for receiving one or more packet flows therefrom;
a processor;
one or more stored sequences of instructions which, when executed by the processor, cause the processor to carry out the steps of:
identifying a network element that has failed;
selecting a substitute network element from among a pool of one or more available network elements;
receiving connection configuration information from the identified network element;
and

based on the connection configuration information, re-configuring the substitute network element and one or more switch devices associated with the identified network element, wherein the re-configuring causes the one or more switch devices to change one or more connections from the identified network element to the substitute network element;

wherein the steps are performed by a cluster manager that is communicatively coupled to a cluster comprising the failed and substitute network elements and the one or more switch devices.

47. (previously presented): The apparatus as recited in Claim 46, wherein the identified network element is one of a plurality of network elements in a cluster that is associated with first and second network switches.
48. (cancelled)
49. (previously presented): The apparatus as recited in Claim 46, wherein the step of re-configuring comprises the steps of sending a trigger event to the substitute network element that causes the substitute network element to retrieve a configuration over a network connection.
50. (previously presented): The apparatus as recited in Claim 46, wherein re-configuring comprises dynamically reconfiguring the selected network element as a logical clone of the identified network element.
51. (previously presented): The apparatus as recited in Claim 46, further comprising the step of associating the identified network element with the pool of available network elements.
52. (previously presented): The apparatus as recited in Claim 46, further comprising the steps of:

sending an initial configuration to the substitute network element;
sending a partial accumulated configuration to the substitute network element; and
sending instructions that cause the identified network element to reboot based on a
configuration setting of a cluster associated with the identified network
element.

53. (previously presented): The apparatus as recited in Claim 46, further comprising the steps of:

receiving first user input in a graphical user interface that associates the network
elements in a cluster with a first switch and a second switch;
receiving second user input that specifies which network elements are reserved in the
pool of available network elements.

54. (previously presented): The apparatus as recited in Claim 46, wherein each of the
network elements is a network aggregation device or a network access server.

55. (previously presented): The apparatus as recited in Claim 46, further comprising
repeating the steps for multiple concurrently failed network elements.

56. (previously presented): The apparatus as recited in Claim 46, further comprising the
steps of:

receiving a message specifying a failure of a network element over an event bus on
which the network elements publish events and on which a cluster manager
subscribes to events;

based on the message, identifying the network element that has failed.

57. (previously presented): The apparatus as recited in Claim 46, wherein the network
switches are asynchronous transfer mode (ATM) switches, and wherein the network
elements are routers in a packet-switched network.

58. (new): The method as recited in Claim 1, further comprising:
the cluster manager managing a plurality of connection objects corresponding to the
number of subscribers in the network.
59. (new): The method as recited in Claim 58, further comprising:
wherein a connection object comprises a programmatic object that points to a fixed
defined set of templates intended to be applied to a stack device and adjacent
switches, and contains attributes providing specific substitution values to be
used when instantiating the templates into actual configurations.
60. (new): The method as recited in Claim 58, further comprising:
when failover occurs, the cluster manager logically re-associating all of the plurality
of connection objects of the failed device with the new device selected from a
pool of available substitute devices.
61. (new): The method as recited in Claim 1, further comprising:
a switch adjacent to a failing node sending an event on an event bus indicating that an
interface on a failing switch is no longer active.
62. (new): The method as recited in Claim 61, further comprising:
the cluster manager receiving notification of the event and identifying a node that has
failed.
63. (new): The method as recited in Claim 63, further comprising:
the cluster manager correlating an interface on the failing switch to a specific stack
element.
64. (new): The method as recited in Claim 1, further comprising:
the cluster manager using a keepalive or heartbeat protocol against a plurality of stack
elements.

65. (new): The method as recited in Claim 1, further comprising:
the cluster manager searching for a device in the free pool that is available for use as
a fail-over device.
66. (new): A method of automatically re-provisioning a network element in adaptation to
a failure, the method comprising the computer-implemented steps of:
identifying a network element that has failed;
selecting a substitute network element from among a pool of one or more available
network elements;
receiving connection configuration information from the identified network element;
and
based on the connection configuration information, re-configuring the substitute
network element and one or more switch devices associated with the
identified network element, wherein the re-configuring causes the one or more
switch devices to change one or more connections from the identified network
element to the substitute network element;
wherein the step of re-configuring comprises the steps of sending a trigger event to
the substitute network element that causes the substitute network element to
retrieve a configuration over a network connection.
67. (new): A method of automatically re-provisioning a network element in adaptation to
a failure, the method comprising the computer-implemented steps of:
identifying a network element that has failed;
selecting a substitute network element from among a pool of one or more available
network elements;

- receiving connection configuration information from the identified network element;
and
based on the connection configuration information, re-configuring the substitute
network element and one or more switch devices associated with the
identified network element, wherein the re-configuring causes the one or more
switch devices to change one or more connections from the identified network
element to the substitute network element;
wherein re-configuring comprises dynamically reconfiguring the selected network
element as a logical clone of the identified network element.
68. (new): A method of automatically re-provisioning a network element in adaptation to a
failure, the method comprising the computer-implemented steps of:
identifying a network element that has failed;
selecting a substitute network element from among a pool of one or more available
network elements;
receiving connection configuration information from the identified network element; and
based on the connection configuration information, re-configuring the substitute network
element and one or more switch devices associated with the identified network
element, wherein the re-configuring causes the one or more switch devices to
change one or more connections from the identified network element to the
substitute network element;
sending an initial configuration to the substitute network element;
sending a partial accumulated configuration to the substitute network element; and
sending instructions that cause the identified network element to reboot based on a
configuration setting of a cluster associated with the identified network element.